IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of:

Applicant(s): Bo Thiesson, *et al.*   Examiner: George B. Davis

Serial No: 10/628,546   Art Unit: 2129

Filing Date: July 28, 2003

Title: DYNAMIC STANDARDIZATION FOR SCORING LINEAR REGRESSIONS IN
        DECISION TREES

Mail Stop Appeal Brief – Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Dear Sir:

        Appellants' representative submits this brief in connection with an appeal of the above-identified patent application. Payment is being submitted via credit card in connection with all fees due regarding this appeal brief. In the event any additional fees may be due and/or are not covered by the credit card, the Commissioner is authorized to charge such fees to Deposit Account No. 50-1063 [MSFTP485US].

I.   Real Party in Interest (37 C.F.R. §41.37(c)(1)(i))

     The real party in interest in the present appeal is Microsoft Corporation, the assignee of the present application.

II.   Related Appeals and Interferences (37 C.F.R. §41.37(c)(1)(ii))

     Appellants, appellants' legal representative, and/or the assignee of the present application are not aware of any appeals or interferences which may be related to, will directly affect, or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III.   Status of Claims (37 C.F.R. §41.37(c)(1)(iii))

     Claims 10, 17, and 24 were cancelled during prosecution. Claims 1-9, 11-16, and 18-23 stand rejected by the Examiner. The rejection of claims 1-9, 11-16, and 18-23 is being appealed.

IV.   Status of Amendments (37 C.F.R. §41.37(c)(1)(iv))

     No amendments have been made or entered subsequent to the Final Office Action dated June 2, 2006.

V.   Summary of Claimed Subject Matter (37 C.F.R. §41.37(c)(1)(v))

     A.   Independent Claim 1

     Independent claim 1 recites a system that facilitates decision tree learning, comprising: a learning component that generates non-standardized data that relates to a split in a decision tree, and a scoring component that scores the split as if the non-standardized data at a subset of leaves of the decision tree had been shifted and/or scaled, such that the non-standardized data can be virtually shifted through omission of a matrix operation. (*See e.g.*, page 4, lines 1-11, page 5, line 23-page 6, line 5, and page 6, line 25-page 7, line 8).

B.   Independent Claim 11

Independent claim 11 recites a system that facilitates data mining, comprising: means for automatically generating a set of non-standardized data associated with a set or subset of data relating to a continuous variable, the non-standardized data associated with a split in a decision tree. (*See e.g.*, page 4, lines 1-11, page 5, line 23-page 6, line 5, and page 6, line 25-page 7, line 8) Independent claim 11 also recites means for automatically scoring the split as if the non-standardized data were shifted and/or scaled, the non-standardized data virtually shifted by omitting a matrix operation from automatically scoring the split. (*See e.g.*, page 4, lines 1-11, page 5, line 23-page 6, line 5, page 6, line 25-page 7, line 8, and page 8, lines 6-13).

The means for limitations described above are identified as limitations subject to the provisions of 35 U.S.C. §112 ¶6. The corresponding structures are identified with reference to the specification and drawings in the parentheticals above corresponding to those claim limitations.

C.   Independent Claim 14

Independent claim 14 recites a method that facilitates decision tree learning, comprising: determining whether to perform a virtual shifting and/or scaling operation on a non-standardized set of data associated with leaves of a decision tree, and automatically assigning scores to the leaves based in part upon the determination of whether to perform the virtual shifting and/or scaling operation, such that the virtual shifting operation includes omitting a matrix operation from the assignment of scores. (*See e.g.*, page 4, lines 1-11, page 5, line 23-page 6, line 5, page 6, line 25-page 7, line 8, and page 10, line 2-page 14, line 20).

D.   Independent Claim 21

Independent claim 21 recites a computer readable medium that includes a tangible component that has a data structure stored thereon, comprising: a first data field describing a non-standardized set or subset of data relating to a continuous variable, a second data field describing a decision tree and associated branches, and a third data field describing a score for the branches, the score computed for the branches as if the non-standardized set or subset of data had been shifted or scaled, the non-standardized set or subset virtually shifted by omission of a

matrix operation from the computed score. (*See e.g.*, page 4, lines 1-11, page 5, line 23-page 6, line 5, page 6, line 25-page 7, line 8, and page 10, line 2-page 14, line 20).

VI.   Grounds of Rejection to be Reviewed (37 C.F.R. §41.37(c)(1)(vi)

     A.   Claims 1-9, 11-16, and 18-23 stand rejected under 35 U.S.C. §101 as it is alleged the claimed invention is directed to non-statutory subject matter.

VII.   Argument (37 C.F.R. §41.37(c)(1)(vii))

A.   <u>Rejection of Claims 1-9, 11-16, and 18-23 Under 35 U.S.C. §101</u>

     Claims 1-9, 11-16, and 18-23 stand rejected under 35 U.S.C. §101 as it is alleged that the claimed invention is directed to non-statutory subject matter. Reversal of this rejection is requested for at least the following reasons. The subject claims recite a useful, concrete and tangible result, and further Examiner concedes the claimed subject matter relates to a computer software program.

> Because the claimed process applies the Boolean principle [abstract idea] *to produce a useful, concrete, tangible result* … on its face the claimed process comfortably falls within the scope of §101. *AT&T Corp. v. Excel Communications, Inc.*, 172 F.3d 1352, 1358. (Fed. Cir. 1999) (Emphasis added); *See State Street Bank & Trust Co. v. Signature Fin. Group, Inc.*, 149 F.3d 1368, 1373, 47 USPQ2d 1596, 1601 (Fed.Cir.1998). The inquiry into patentability requires an examination of the contested claims to see if the claimed subject matter, as a whole, is a disembodied mathematical concept representing nothing more than a "law of nature" or an "abstract idea," or if the mathematical concept has been *reduced to some practical application rendering it "useful.*" *AT&T* at 1357 *citing In re Alappat*, 33 F.3d 1526, 31 1544, 31 U.S.P.Q.2D (BNA) 1545, 1557 (Fed. Cir. 1994) (emphasis added).

     Independent claims 1, 11, 14, and 21 produce one or more useful, concrete and tangible results. Independent claim 1 (and similarly, independent claims 11, 14, and 21) recites: *a learning component that **generates non-standardized data that relates to a split in a decision tree;** and a scoring component that **scores the split as if the non-standardized data at a subset***

of leaves of the decision tree had been virtually shifted and/or scaled, the non-standardized
data shifted through omission of a matrix operation.

Appellants' claimed invention yields a number of useful, concrete and tangible results. Specifically, generating non-standardized data that relates to a split in a decision tree; and scoring the split as if the non-standardized data at a subset of leaves of the decision tree had been shifted and/or scaled. All the aforementioned results are useful, concrete and tangible.

In the Office Action dated December 9, 2005 Examiner contended 35 U.S.C. §101 required claims be tied to a technological art, environment or machine. In response appellants' representative asserted United States patent law had never supported the application of a "technological aspect" or "technological arts" requirement. Title 35 of the United States Code does not recite, explicitly or implicitly, that inventions must be within the "technological arts" to be patentable. Section 101 of Title 35 recites "[w]hoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefore …" Accordingly, while an invention must be "new" and "useful," there is no statutory requirement that it fit within a category of "technological arts." Moreover, while there has been some judicial discussion of the expression "technological arts" and its relationship to patentability, this dialogue has been limited and its viability questioned.

In 1970, the Court in *In re Musgrave*, 431 F.2d 882, 167 USPQ 280 (CCPA 1970) introduced a standard for evaluating process claims under Section 101: any sequence of operational steps is a patentable process so long as it is within the technological arts so as to promote the progress of useful arts. While a few subsequent courts have made reference to this so-called "technological arts" standard, the Supreme Court in *Gottschalk v. Benson*, 409 U.S. 63, 175 USPQ 673 (1972) refused to adopted this standard when it reversed the Court of Customs and Patent Appeals decision in the aforementioned case.

Moreover, the Court of Customs and Patent Appeals effectively rejected the technological arts test in *In re Toma*, 575 F.2d 872, 878, 197 USPQ 852, 857 (CCPA 1978), by strongly suggesting that *Musgrave* was never intended to create a technological arts test for patent eligibility:

The language which the examiner has quoted [from *Musgrave* and its

> progeny relating to "technological arts"] was written in answer to "mental steps" rejections and was not intended to create a generalized definition of statutory subject matter. Moreover, it was not intended to form a basis for a new § 101 rejection as the examiner apparently suggests. *In re Toma*, 575 F.2d at 878, 197 USPQ at 857.

Furthermore, the "technological arts" consideration is completely devoid from recent Federal Circuit cases like *AT&T Corp. v. Excel Communications, Inc.*, 172 F.3d 1352, (Fed. Cir. 1999), and *State Street Bank & Trust Co. v. Signature Fin. Group, Inc.*, 149 F.3d 1368, 1373, 47 USPQ2d 1596, 1601 (Fed.Cir.1998).

It is submitted that the "technological arts" requirement propounded by *Musgrave* should be confined to its facts and holding, *i.e.*, that the computer-related invention in dispute was a patentable invention within the meaning of Section 101 because it was an advancement in technology which clearly promoted the useful arts. Thus, the decision in *Musgrave* should not be construed as a "technological arts" requirement for patentability, but rather as a proposition that computer-implemented process claims might be patentable subject matter.

Further, in *Ex parte Lundgren*, Appeal No. 2003-2088, Application 08/093,516, (Precedential BPAI opinion September 2005), the Board rejected the Examiner's argument that *Musgrave* and *Toma* created a technological arts test. "We do not believe the court could have been any clearer in rejecting the theory the present examiner now advances in this case." *Lundgren*, at 8. The Board held that "there is currently no judicially recognized separate 'technological arts' test to determine patent eligible subject matter under § 101." *Lundgren*, at 9. Thus, in view of the foregoing it is evident that there are no recognized exceptions to eligible subject matter other than laws of nature, natural phenomena, and abstract ideas.

Additionally, in the Office Action dated December 9, 2005, Examiner also contended the claims were directed to abstract ideas. Appellants' response asserted that such contentions do not comport with the reality that the subject claims recite useful, concrete and tangible results, *viz.*, generating non-standardized data that relates to a split in a decision tree; and scoring the split as if the non-standardized data at a subset of leaves of the decision tree had been shifted and/or scaled. The fact that the claims might utilize abstract ideas to render a result is neither germane nor relevant to the determination of whether ***the result*** itself is ***useful, concrete and tangible***. According to *AT&T Corp. v. Excel Communications, Inc.* all that is required is that the

"concept has been *reduced to some practical application rendering it 'useful.'*" *AT&T* at 1357 *citing In re Alappat*, 33 F.3d 1526, 1544, 31 USPQ2d (BNA) 1545, 1557 (Fed. Cir. 1994) (emphasis added).

In the Final Office Action dated June 2, 2006, Examiner contended the language of the subject claims is directed merely to an abstract idea that would not be a practical application that produces a tangible result. In response, appellants' argued that according to *AT&T Corp. v. Excel Communications, Inc.*, 172 F.3d 1352, (Fed. Cir. 1999), the legal standard set forth by the Federal Circuit for ascertaining whether claims are directed towards statutory subject matter is whether the claims can be applied in a practical application to produce a useful, concrete and tangible result. It is the result of the claims as applied in a practical application that is the sole determinant as to whether claims are directed towards statutory subject matter, not whether the underlying means by which the result is effectuated that should be tangible. It is submitted that the subject claims clearly meet the aforementioned legal standard wherein non-standardized data that relates to a split in a decision tree is generated, and the split is scored as if the non-standardized data at a subset of leaves of the decision tree had been shifted and/or scaled.

In the Advisory Action dated August 14, 2006, Examiner is of the opinion that the useful, concrete and tangible results elucidated above are results of a computer software program, and as such are non-statutory. It is respectfully submitted, the subject claims, as the Examiner acknowledges, pertain to software code that generate non-standardized data that relates to a split in a decision tree; and scores the split as if the non-standardized data at a subset of leaves of the decision tree had been shifted and/or scaled. Consequently, as the recent Federal Court decision in *Eolas Techs., Inc. v. Microsoft Corp.*, 399 F.3d 1325 (Fed. Cir. 2005) indicates, provided the claimed subject matter does not fall within the ambit of prohibited mathematical concept, law of nature or abstract idea, that "[w]ithout question, *software code alone qualifies as an invention eligible for patenting under these categories*, at least as processes." *Eolas Techs., Inc. v. Microsoft Corp.*, 399 F.3d 1325, 1338 (Fed. Cir. 2005) (emphasis added). The court in *Eolas*, contrary to the Examiner's assertion, does not preclude software code embodied in a machine, manufacture or composition of matter from falling within the purview of patentable subject matter. It is thus appellant's representative's contention that claims 1-9, 11-16, and 18-23 at the very least fall squarely within the ambit of *Eolas* and thus are eligible for patenting under 35 U.S.C. §101. Accordingly, this rejection should be reversed.

B.   **Conclusion**

For at least the above reasons, the claims currently under consideration are believed to be patentable over the cited references. Accordingly, it is respectfully requested that the rejections of claims 1-9, 11-16, and 18-23 be reversed.

If any additional fees are due in connection with this document, the Commissioner is authorized to charge those fees to Deposit Account No. 50-1063.

Respectfully submitted,
AMIN, TUROCY & CALVIN, LLP

/Himanshu S. Amin/
Himanshu S. Amin
Reg. No. 40,894

AMIN, TUROCY & CALVIN, LLP
24th Floor, National City Center
1900 East 9th Street
Telephone: (216) 696-8730
Facsimile: (216) 696-8731

VIII.   Claims Appendix (37 C.F.R. §41.37(c)(1)(viii))

1.   A system that facilitates decision tree learning, comprising:

a learning component that generates non-standardized data that relates to a split in a decision tree; and

a scoring component that scores the split as if the non-standardized data at a subset of leaves of the decision tree had been shifted and/or scaled, the non-standardized data virtually shifted through omission of a matrix operation.

2.   The system of claim 1, further comprising a modification component that for a respective candidate split score, the data is modified by shifting and/or scaling the data and a new score is computed on the modified data.

3.   The system of claim 1, further comprising an optimization component that analyzes the data and decides to treat the data as if it was: (1) shifted, (2) scaled, or (3) shifted and scaled.

4.   The system of claim 1, the scoring component is employed for evaluating a data mining application.

5.   The system of claim 1, the learning component processes continuous variable data or data subsets.

6.   The system of claim 1, the scoring component generates evaluation indicating how well a model predicts continuous target data and whether or not the model is a suitable predictor for the target data.

7.   The system of claim 6, the evaluation data is employed by users and/or subsequent automated components when determining model performance and/or selecting between models or model subsets.

8.   The system of claim 1, the scoring component includes at least one of a data sample processor, a scoring constant, a gamma function, a matrix value, a vector value, and a mean value for data or a data subset.

9.   The system of claim 1, the scoring component computes a Bayesian linear regression score as:

$$score = \pi^{-n/2} \left(\frac{v}{v'+n}\right)^{1/2} \left(\frac{\Gamma\left(\frac{\alpha+n}{2}\right)}{\Gamma\left(\frac{\alpha}{2}\right)}\right) \left(\beta^{\frac{\alpha+r}{2}}\right) \frac{\left(\left|\mathbf{T_n^{TR}}\right|\right)^{\left(\frac{\alpha+n}{2}\right)}}{\left(\left|\mathbf{T_n^{R}}\right|\right)^{\left(\frac{\alpha-1+n}{2}\right)}},$$

$$\mathbf{T_n} = \mathbf{T_0} + \mathbf{S_n} + \mathbf{U_n}$$

$$\mathbf{U_n} = \frac{vn}{v'+n}(\overline{\mu}_0 - \overline{m}_n)(\overline{\mu}_0 - \overline{m}_n)'$$

$$\mathbf{S_n} = \sum_{i=1}^{n}(\overline{x}_i - \overline{m}_n)(\overline{x}_i - \overline{m}_n)'$$

$$\overline{m}_n = \frac{1}{n}\sum_{i=1}^{n}\overline{x}_i$$

wherein μ represents a mean, α denotes a degree of freedom, β connotes a pre-defined constant, bold-face symbols denote square matrices, symbols with overlines denote (one dimensional) vectors, the $'$ symbol denotes transpose, and $||$ denotes determinant, n represents a number of records in the data, Γ is a gamma function satisfying $\Gamma(x) = (x-1) \Gamma(x-1)$, $\overline{x}_i$ denotes a vector of values for relevant variables in an ith case in the data, the superscripts TR and R in $\mathbf{T_n^{TR}}$ and $\mathbf{T_n^{R}}$ denote that the matrices are defined with respect to target and regressor variables in a first case and regressor variables in a second case.

10.   (Cancelled).

11.   A system that facilitates data mining, comprising:

        means for automatically generating a set of non-standardized data associated with a set or subset of data relating to a continuous variable, the non-standardized data associated with a split in a decision tree; and

        means for automatically scoring the split as if the non-standardized data were shifted and/or scaled, the non-standardized data virtually shifted by omitting a matrix operation from automatically scoring the split.

12.   The system of claim 11, further comprising means for determining whether to perform the shifting and/or scaling operations.

13.   The system of claim 11, further comprising means for shifting and/or scaling the set or subset of data relating to the continuous variable.

14.   A method that facilitates decision tree learning, comprising:

        determining whether to perform a virtual shifting and/or scaling operation on a non-standardized set of data associated with leaves of a decision tree; and

        automatically assigning scores to the leaves based in part upon the determination of whether to perform the virtual shifting and/or scaling operation, the virtual shifting operation includes omitting a matrix operation from the assignment of scores.

15.   The method of claim 14, further comprising performing at least one actual scaling and/or shifting operation on the non-standardized set of data.

16.   The method of claim 14, further comprising processing a model in a form of a linear regression.

17.   (Cancelled).

18.   The method of claim 14, the virtual shifting operation includes modifying a subset of elements relating to a covariance matrix.

19.   The method of claim 14, determining at least one constant value before assigning the scores.

20.   The method of claim 19, the constant value relates to diagonal elements of a matrix and is assigned a value of about 0.01.

21.   A computer readable medium that includes a tangible component that has a data structure stored thereon, comprising:

    a first data field describing a non-standardized set or subset of data relating to a continuous variable;

    a second data field describing a decision tree and associated branches; and

    a third data field describing a score for the branches, the score computed for the branches as if the non-standardized set or subset of data had been shifted or scaled, the non-standardized set or subset virtually shifted by omission of a matrix operation from the computed score.

22.   The computer readable medium of claim 21, further comprising a data field to indicate at least one of a virtual shifting operation and a virtual scaling operation.

23.   The computer readable medium of claim 21, further comprising a data field to indicate at least a portion of the non-standardized set or subset of data is to be shifted and/or scaled.

24.   (Cancelled)

IX.   Evidence Appendix (37 C.F.R. §41.37(c)(1)(ix))

    None.

X.   Related Proceedings Appendix (37 C.F.R. §41.37(c)(1)(x))

    None.